

What is claimed is:

1 1. A method for evaluating overlay registration,
2 comprising:
3 forming a first pattern on a wafer by
4 photolithography with a first reticle having a
5 first reticle pattern thereon;
6 forming a photoresist layer on the wafer;
7 patterning the photoresist layer to form a second
8 pattern by photolithography with a second
9 reticle having a second reticle pattern
10 thereon;
11 measuring deviations between the first and second
12 patterns on the wafer along X, Y, or X and Y
13 axes;
14 calibrating a scaling value and an overlay offset of
15 the deviations to obtain an overlay
16 registration value; and
17 determining whether the registration value is out of
18 specification.

1 2. The method as claimed in claim 1, wherein the
2 first and second reticle patterns are patterns for active
3 regions, gate layers, deep trenches for capacitors,
4 contact openings, bit line openings or a layer of
5 interconnection.

1 3. The method as claimed in claim 1, wherein the
2 deviations of the wafer are measured with a critical
3 dimension scanning electron microscope (CD-SEM) from the
4 top thereof.

1 4. The method as claimed in claim 1, wherein the
2 first/second pattern is formed by transferring the
3 first/second reticle pattern step-and-repeatedly onto the
4 wafer/photoresist layer A times, resulting in the
5 first/second pattern consisting of A transferred
6 patterns.

1 5. The method as claimed in claim 4, wherein
2 deviations between the first and second patterns are
3 measured by selecting B transferred patterns from the A
4 transferred patterns for measurement with $B \leq A$.

1 6. The method as claimed in claim 5, wherein the
2 first/second pattern consisting of A transferred patterns
3 is rectangular and the B transferred patterns are
4 selected from transferred patterns on the four corners
5 and center of the first/second pattern.

1 7. The method as claimed in claim 5, wherein the
2 deviations along X or Y axis are calculated by the steps
3 of:

4 selecting a plurality of points from each of the B
5 transferred patterns along X or Y axis; and
6 measuring the deviations between the first and
7 second patterns on the selective points.

1 8. The method as claimed in claim 7, wherein the
2 points selected along X-axis are selected from N points
3 in M rows along X axis of each selected transferred
4 pattern, and the points selected along Y axis are

5 selected from Q points in P columns along Y axis of each
6 selected transferred pattern.

1 9. The method as claimed in claim 8, wherein the
2 scaling value is a slope (S) obtained by linear
3 regression of the deviations of the N point in each row
4 along X axis, or a slope (S) obtained by linear
5 regression of the deviations of the Q point on each
6 column along Y axis.

1 10. The method as claimed in claim 9, wherein the
2 overlay offset of each selected row or column is an
3 average value of the deviations with scaling calibration.

1 11. The method as claimed in claim 9, wherein
2 determination of whether the registration value is out of
3 specification is calculated by a statistical method.

1 12. The method for evaluating overlay registration,
2 comprising:

3 forming a first pattern on a wafer by
4 photolithography with a first reticle having a
5 first reticle pattern thereon;

6 forming an anti-reflection layer on the wafer

7 forming a photoresist layer on the anti-reflection
8 layer;

9 patterning the photoresist layer and the anti-
10 reflection layer to form a second pattern by
11 photolithography with a second reticle having a
12 second reticle pattern thereon;

13 removal of the anti-reflection layer from the second
14 pattern;

15 measuring deviation between the first and second
16 patterns on the wafer along X, Y or X and Y
17 axes;
18 calibrating a scaling value and an overlay offset of
19 the deviations to obtain an overlay
20 registration value; and
21 determining whether the registration value is out of
22 specification.

1 13. The method as claimed in claim 12, wherein the
2 first and second reticle patterns are patterns of active
3 regions, gate layers, deep trenches for capacitors,
4 contact openings, bit line openings or a layer of
5 interconnection.

1 14. The method as claimed in claim 13, wherein the
2 deviations of the wafer are measured with a critical
3 dimension scanning electron microscope (CD-SEM) from the
4 top thereof.

1 15. The method as claimed in claim 12, wherein the
2 first/second pattern is formed by transferring the
3 first/second reticle pattern step-and-repeatedly onto the
4 wafer/photoresist layer A times, resulting in the
5 first/second pattern consisting of A transferred
6 patterns.

1 16. The method as claimed in claim 15, wherein the
2 deviations between the first and second patterns are
3 measured by selecting B transferred patterns from the A
4 transferred patterns for measurement with $B \leq A$.

1 17. The method as claimed in claim 16, wherein the
2 first/second pattern consisting of the A transferred
3 patterns is rectangular and the B transferred patterns
4 are selected from transferred patterns on the four
5 corners and center of the first/second pattern.

1 18. The method as claimed in claim 16, wherein the
2 deviations along X or Y axis is calculated by the steps
3 of:

4 selecting a plurality of points from each of the B
5 transferred patterns along X- or Y-axis; and
6 measuring the deviations between the first and
7 second patterns on the selective points.

1 19. The method as claimed in claim 18, wherein the
2 points selected along X-axis are selected from N points
3 in M rows along X-axis of each selected transferred
4 pattern, and the points along Y-axis from Q points in P
5 columns along Y-axis of each selected transferred
6 pattern.

1 20. The method as claimed in claim 19, wherein the
2 scaling value is a slope (S) obtained by linear
3 regression of the deviations of the N point on each row
4 along X-axis, or a slope (S) obtained by linear
5 regression of the deviations of the Q point on each
6 column along Y axis.

1 21. The method as claimed in claim 20, wherein the
2 overlay offset of each selected row or column is an
3 average value of the deviations with scaling calibration.

1 22. The method as claimed in claim 12, wherein
2 determination of whether the registration value is out of
3 specification is calculated by a statistical method.

1 23. A method for fabricating a wafer sample for
2 inspection of a critical dimension scanning electron
3 microscope (CD-SEM), comprising the steps of:

4 forming a first pattern on a wafer by a first
5 reticle;

6 forming a photoresist layer on the wafer; and
7 patterning the photoresist layer to form a second
8 pattern with a second reticle, thereby forming
9 a wafer sample for CD-SEM inspection.

1 24. A method for fabricating a wafer sample for
2 inspection by a critical dimension scanning electron
3 microscope (CD-SEM), comprising the steps of:

4 forming a first pattern on a wafer by a first
5 reticle;

6 forming a photoresist layer on the wafer;
7 forming an anti-reflection layer on the photoresist
8 layer;

9 patterning the anti-reflection layer and the
10 photoresist layer to form a second pattern with
11 a second reticle;

12 removal of the anti-reflection layer from the second
13 pattern, thereby forming a wafer sample for CD-
14 SEM inspection.